Avalanche Hazards in Mountainous Terrain

Avalanche Hazards Terminal Learning Objective

Action: Move safely in avalanche terrain.

Condition: Under field conditions in avalanche terrain, given beacons, probes, shovels, inclinometer, military snowshoe, bindings, ski poles, survival rucksack (packed IAW training schedule), vapor barrier boots, rucksack (with a minimum load of sleeping bag, sleeping pad, extra pair of socks, extra pair of mitten inserts, additional packing list items may be prescribed by unit), ECWCS, other issued cold weather clothing items, ballistic helmet, LCE with 2 quarts of water, and weapon

Standard: Student evaluated avalanche potential in different areas. Student chose safe routes in terrain with avalanche potential. Student utilized special equipment to

What is an avalanche?

Definition:
An avalanche is a mass of snow sliding down a mountainside. Avalanches are also called snow slides; there is no difference in these terms.

Types of Avalanches

1. Loose snow avalanche or point release avalanche

2. Slab avalanche

Point Release Avalanche

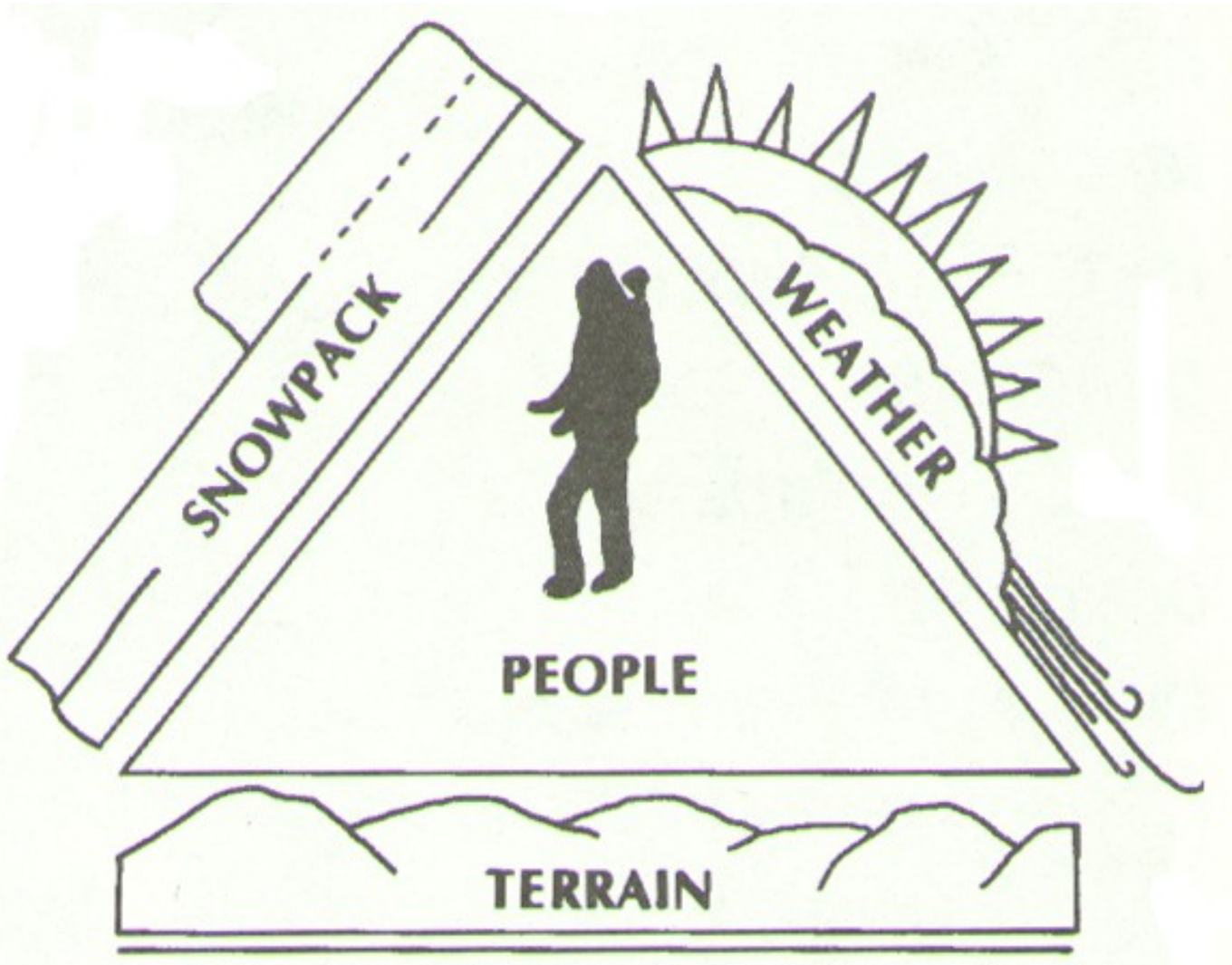
ALTHOUGH USUALLY SMALL,THEY CAN TRIGGER A SLAB TO RELEASE

Slab Avalanche

Avalanche Debris

Avalanche Debris

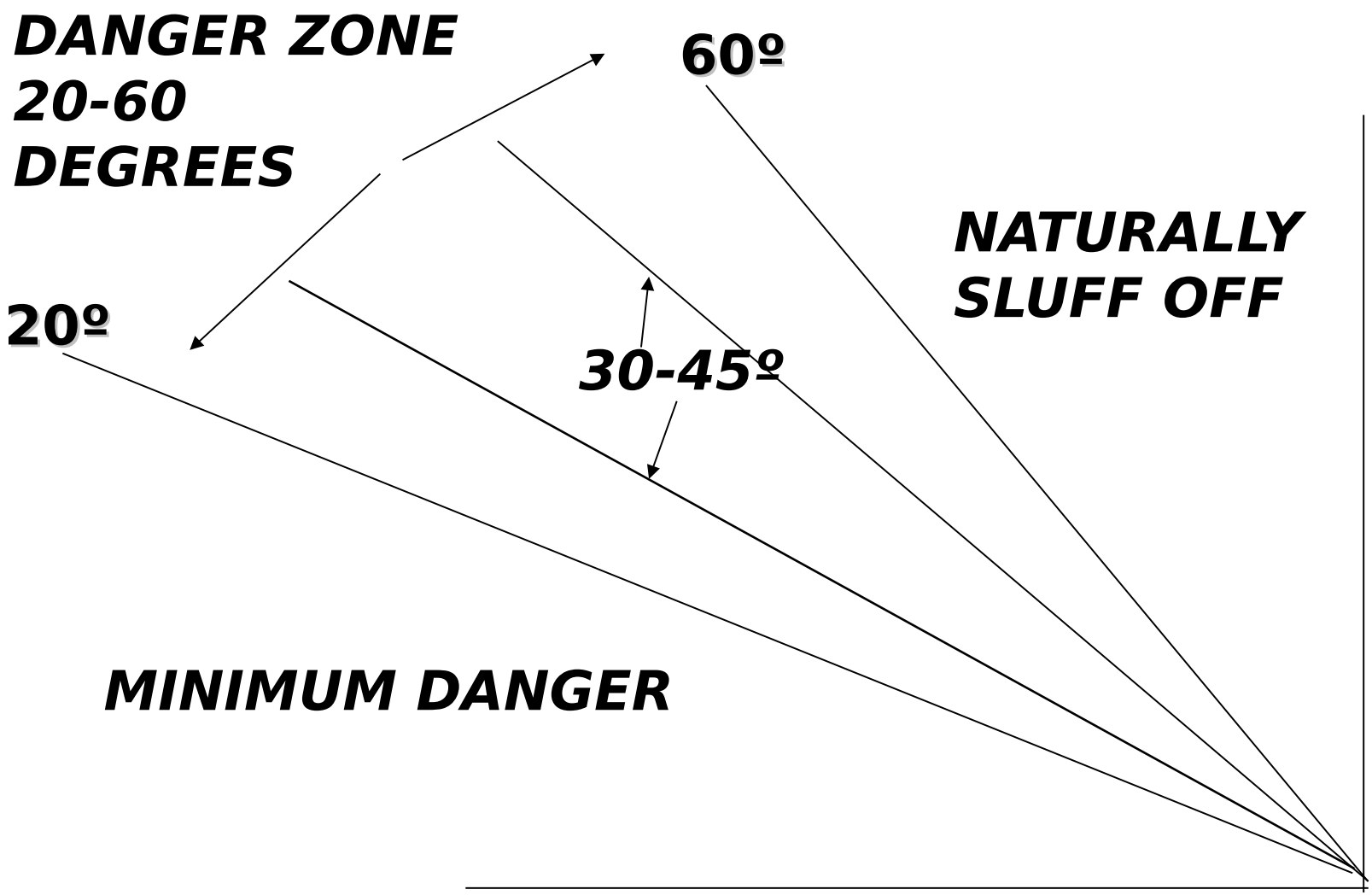
Recognizing the Hazard



Terrain

- ***Can it slide? Is it capable of producing avalanches?***
- ***How do I measure the Slope Angle?***
- ***Terrain characteristics***

Slope Angle: Can it Slide?



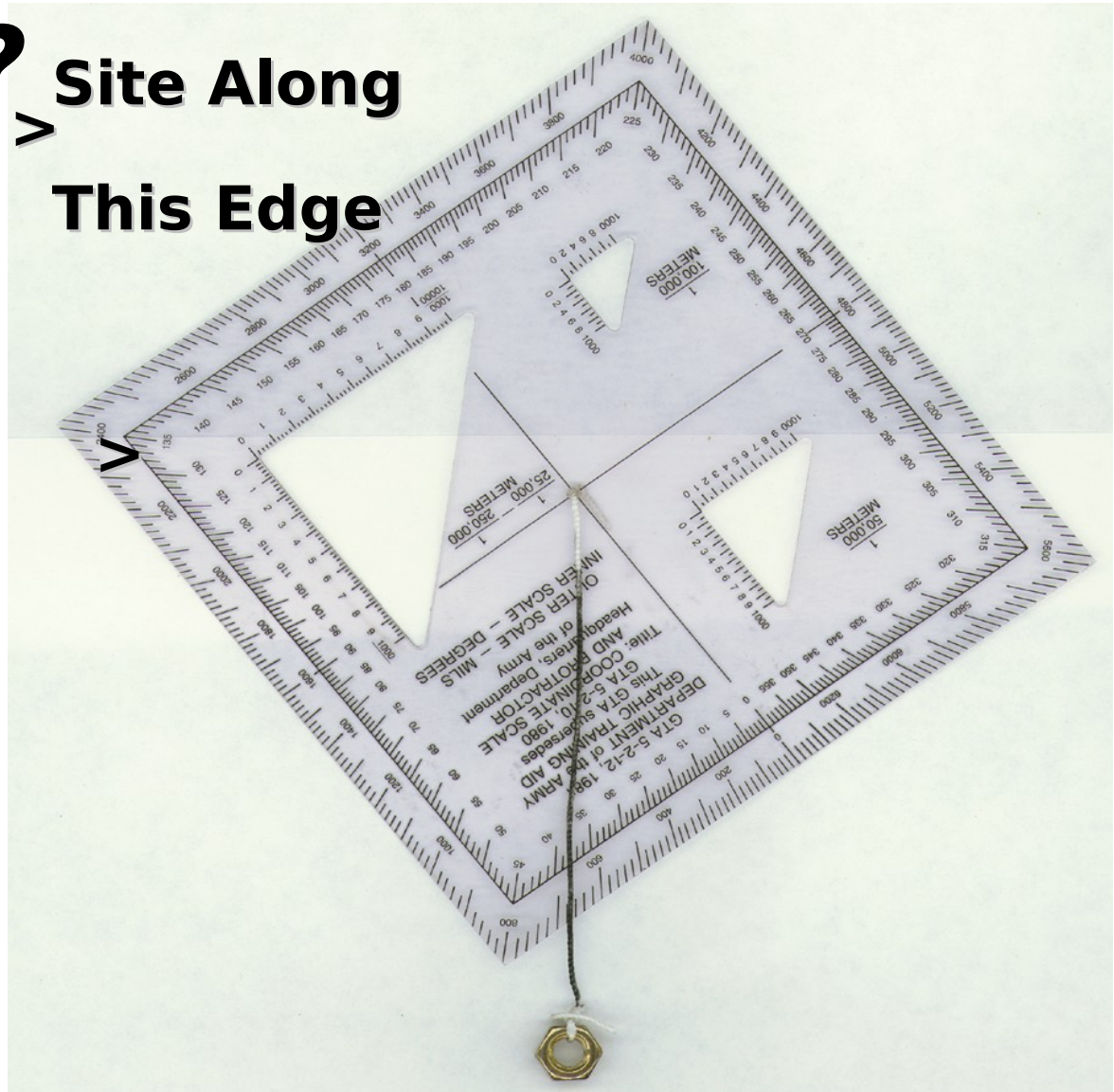
How do I measure the slope angle?

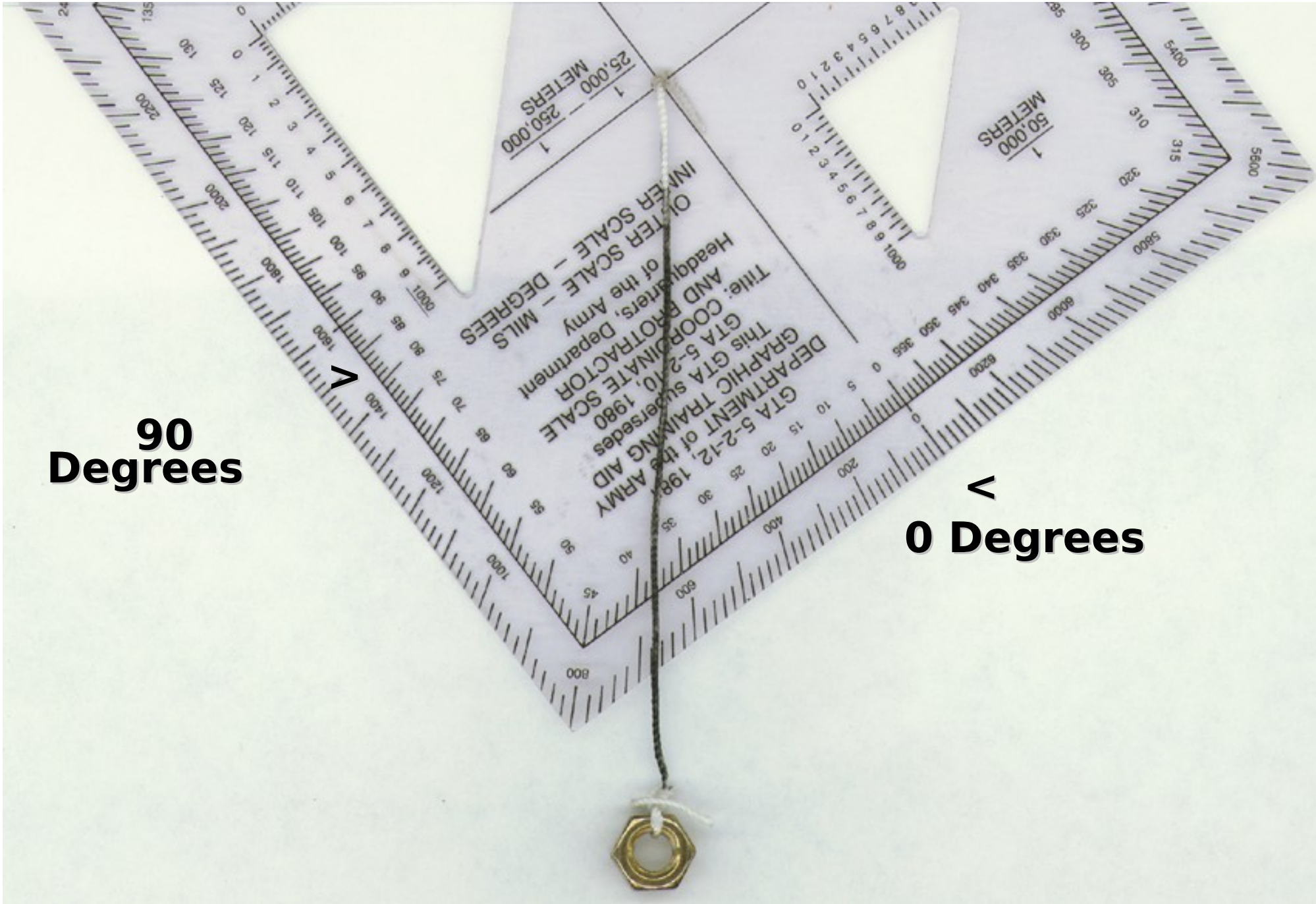
Site Along

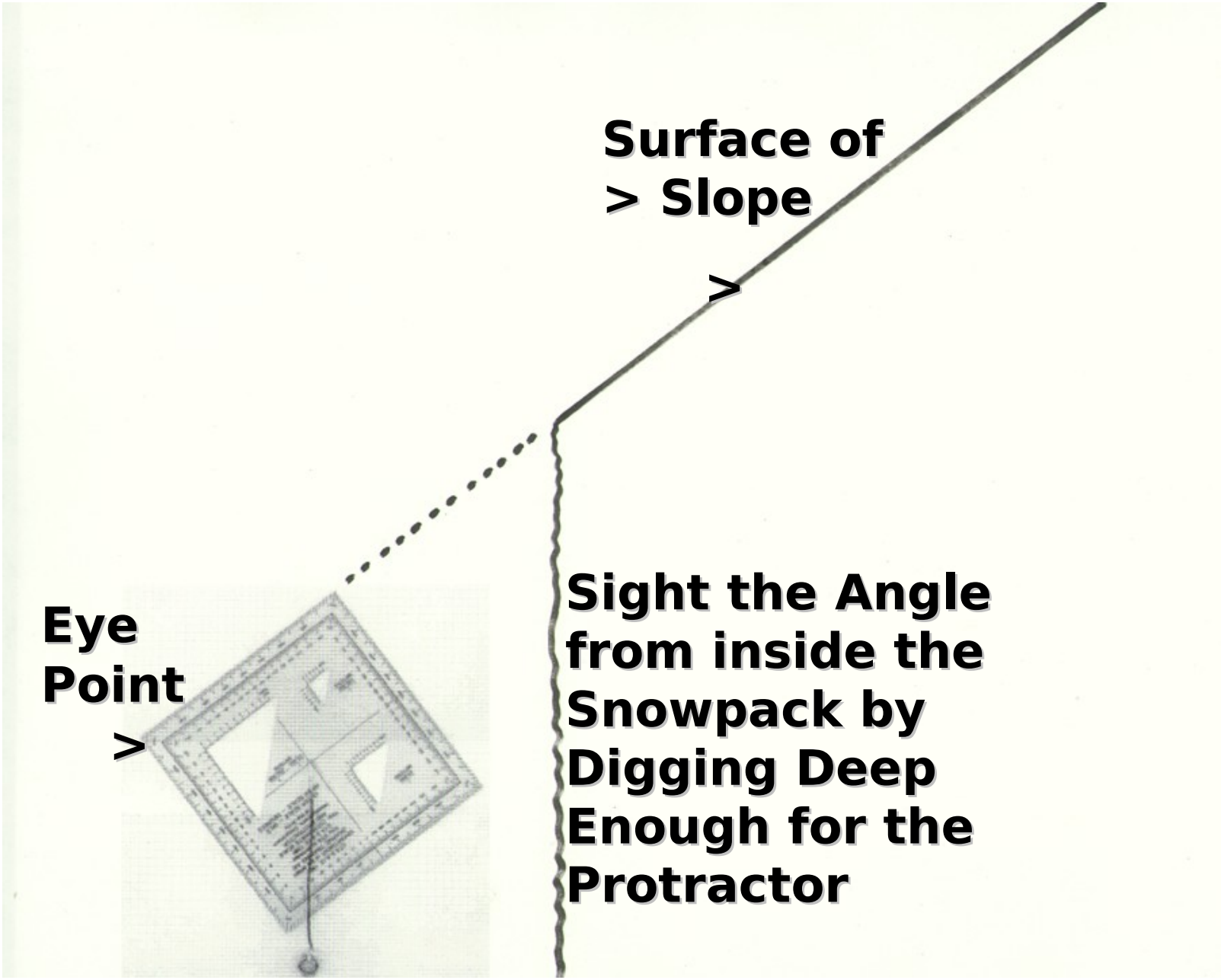
>

This Edge

V




90
Degrees
<
0 Degrees

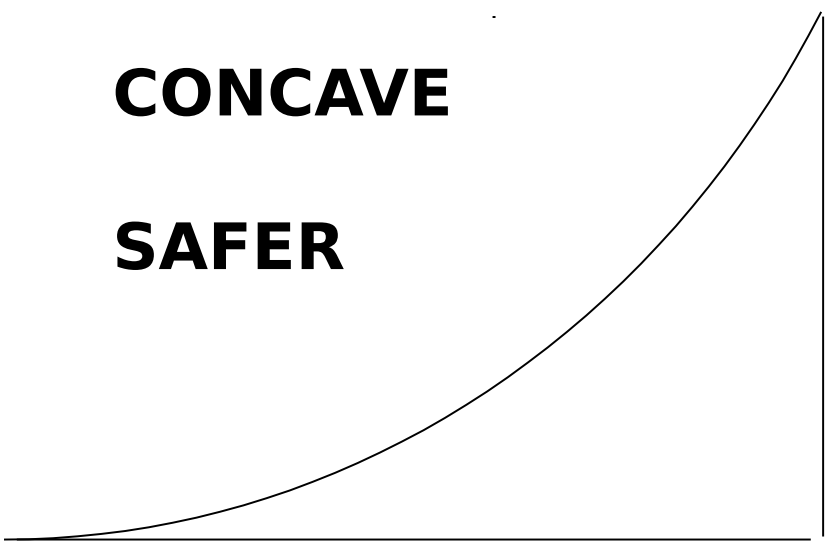

Surface of
> Slope
Eye
Point
Sight the Angle
from inside the
Snowpack by
Digging Deep
Enough for the
Protractor

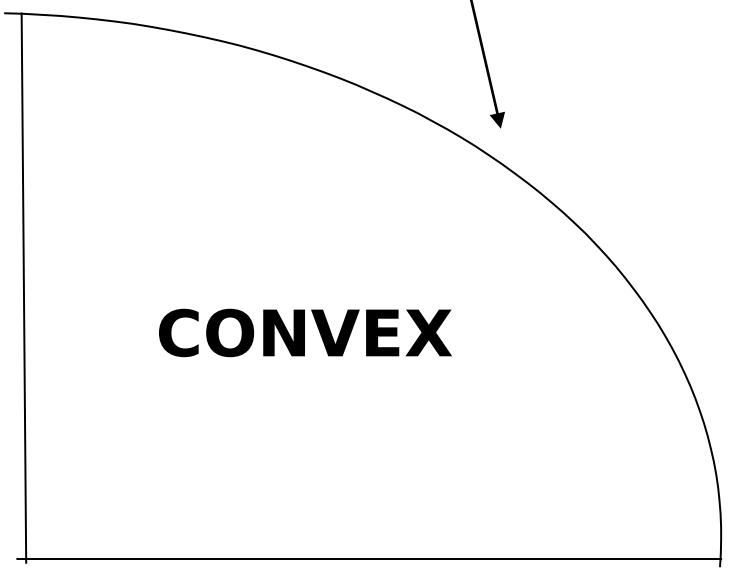
Slope Shape

MORE STRESS

CONCAVE

SAFER





CONVEX

Anchors

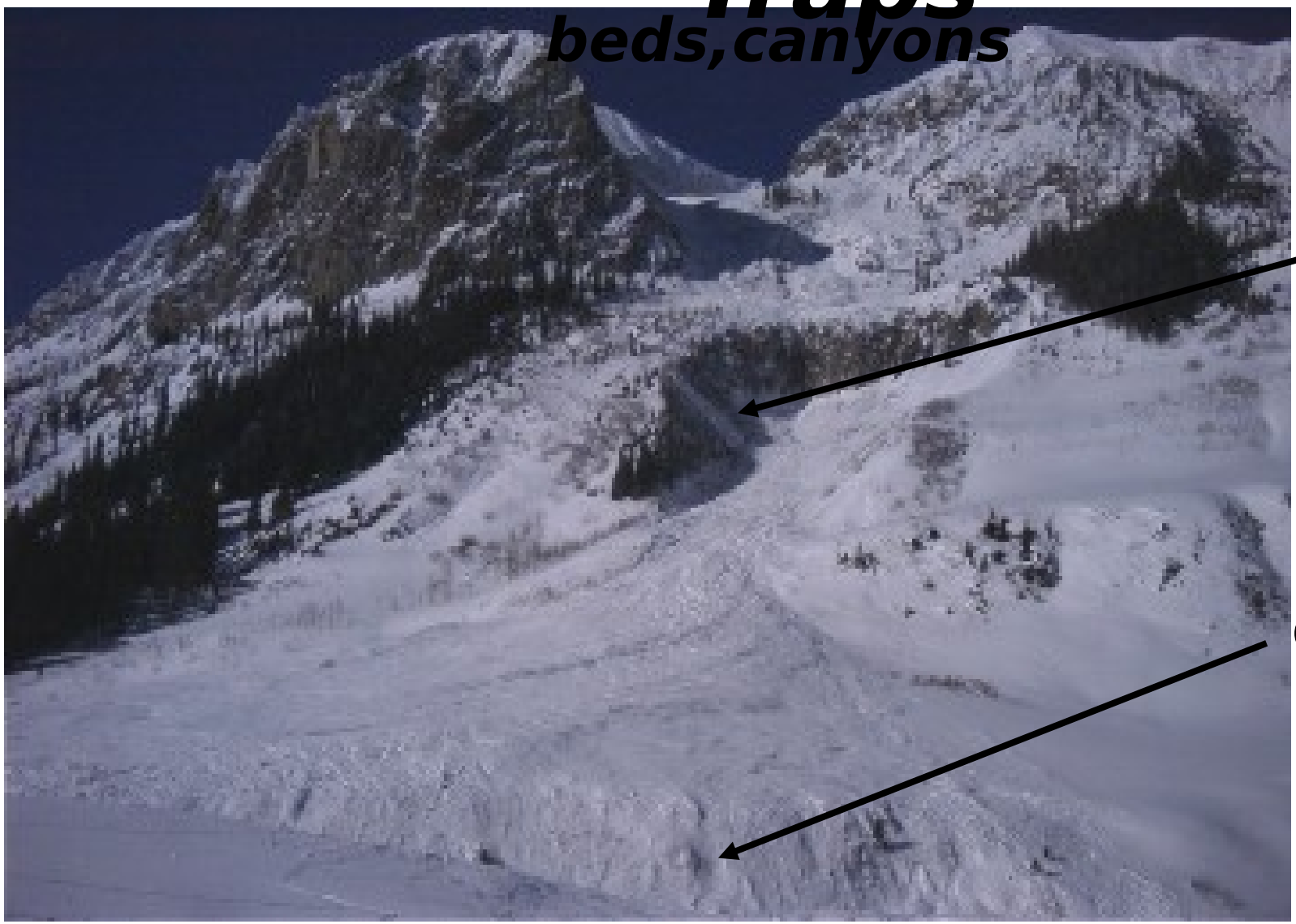
- ***Grassy slopes or smooth rock make for an unstable slope***

- ***Jumbled rock, deadfall will anchor bottom layers***

- ***Trees will anchor surrounding snow, but***
- ***beware of snow above tree line coming down***

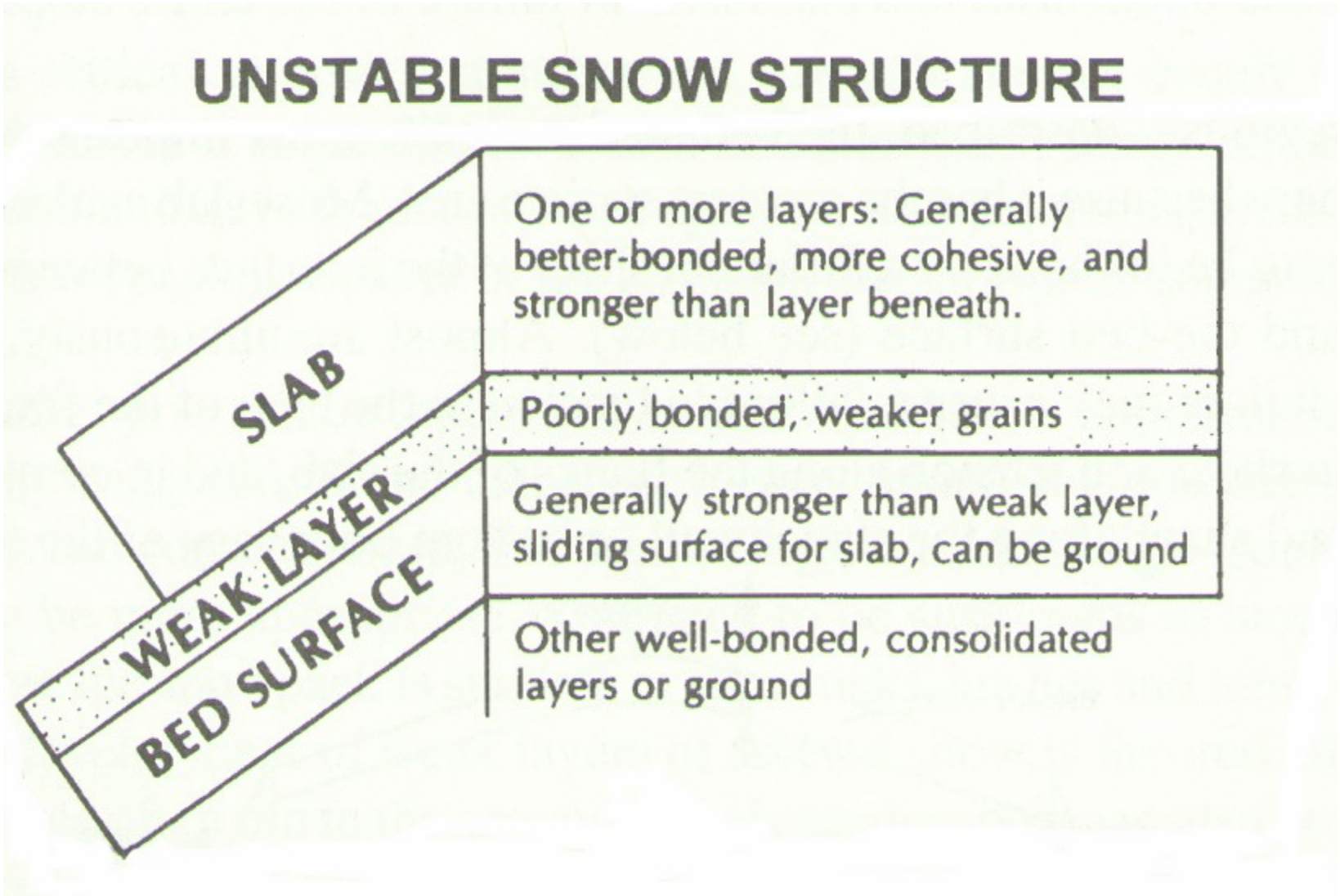
Terrain Traps

Gullies,cirques,creek beds,canyons



Terrain Traps

Snowpack: Ingredients for an Avalanche


UNSTABLE SNOW STRUCTURE
SLAB
WEAK LAYER
BED SURFACE
One or more layers: Generally better-bonded, more cohesive, and stronger than layer beneath.
Poorly bonded, weaker grains
Generally stronger than weak layer, sliding surface for slab, can be ground
Other well-bonded, consolidated layers or ground

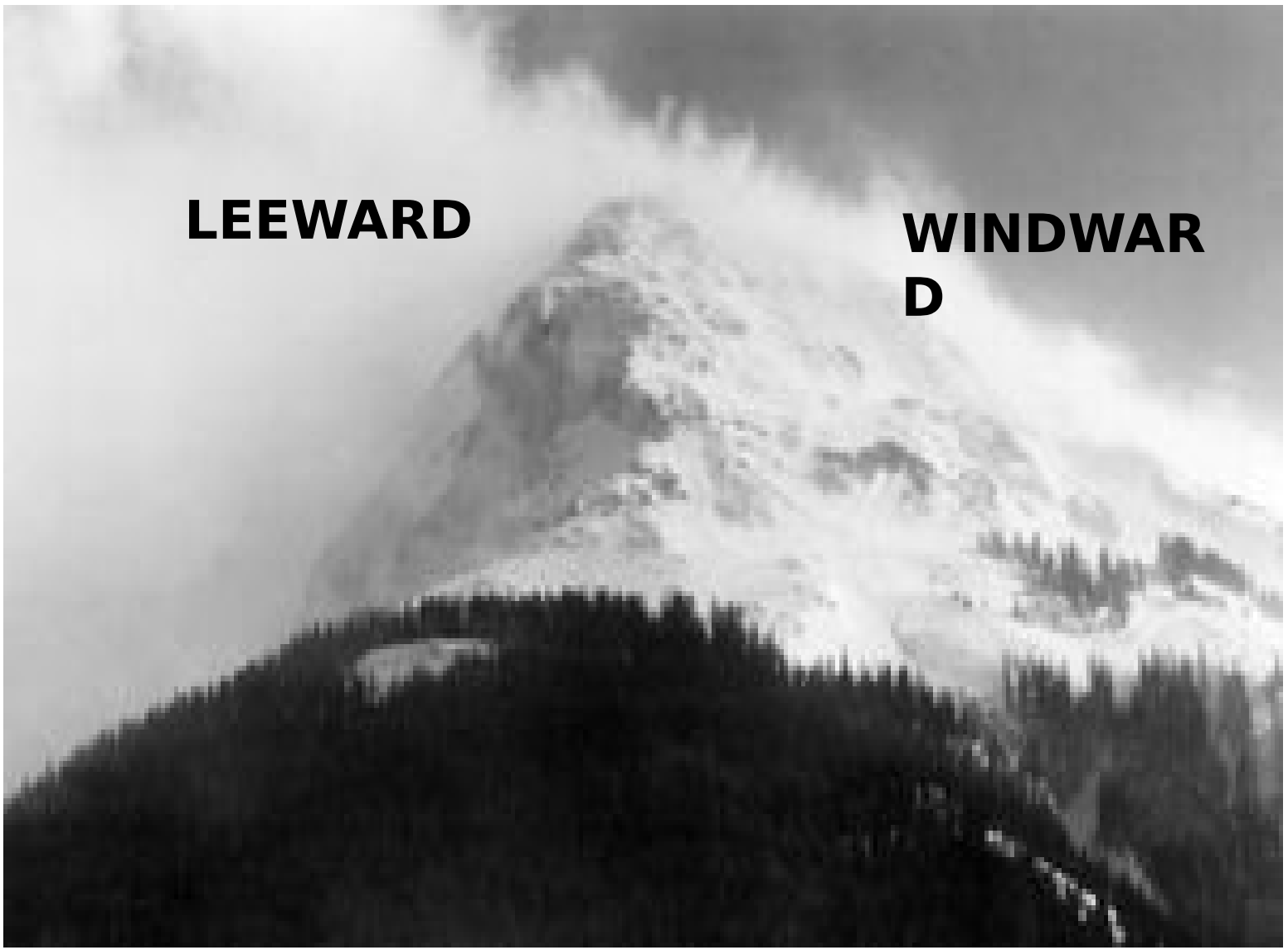
Weather

- ***Wind Action***
- ***Precipitation***
- ***Slope***

  Aspect
- ***Temperature***

Wind Loading

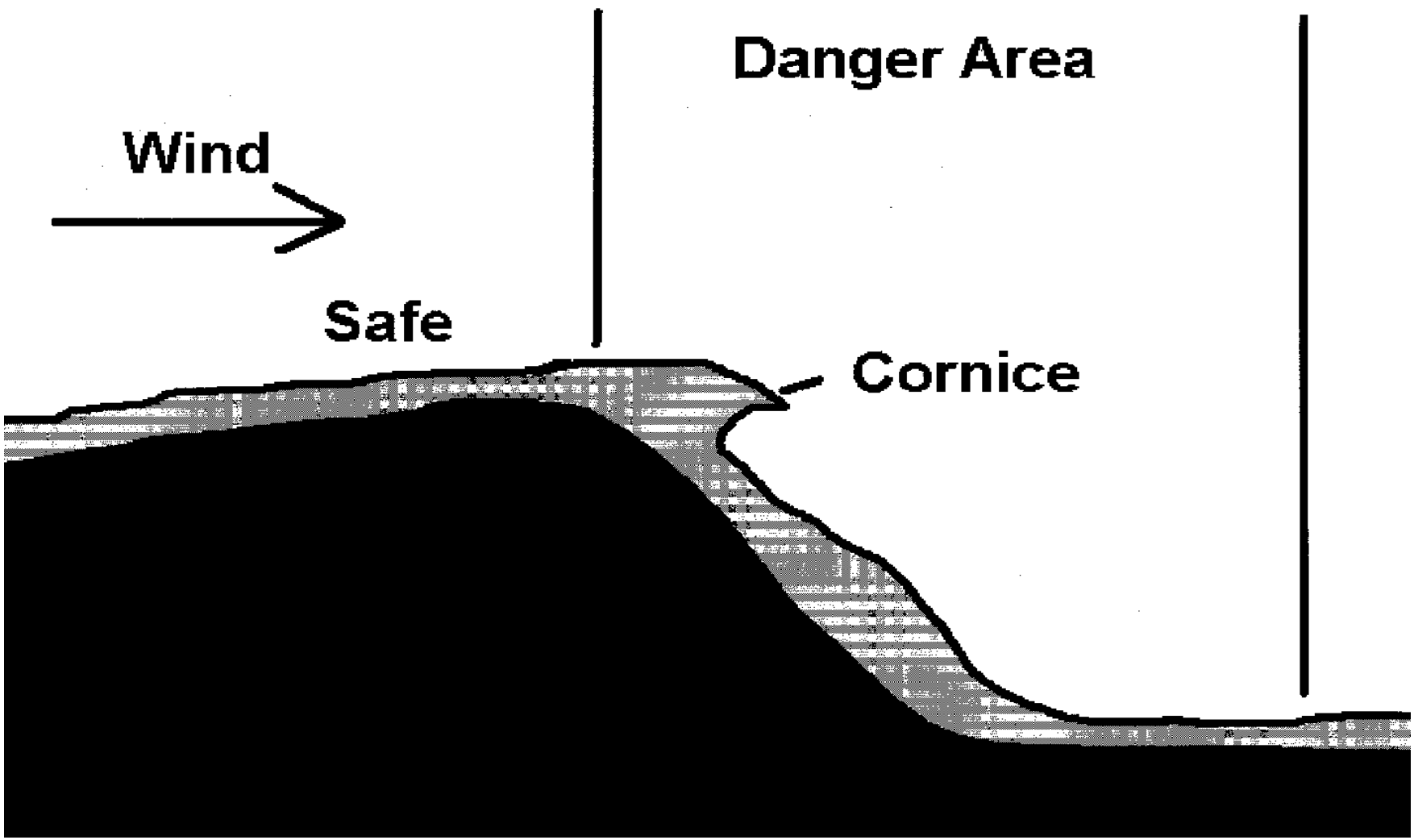
Wind moves snow from one area to another forming a wind slab



Wind Loading

Side Loading

Cornice



Cornice

Cornice

Precipitation

- ***Snow Fall***

- ***Slush (Rain Caused)***

Slope Aspect

- ***North facing slopes are avalanche prone in mid-winter***

- ***South facing slopes are more dangerous in spring and on sunny days***

Temperature

- ***Wet slab avalanches from excess warmth or rain***

- ***Determines bonding of the snow through the freeze thaw cycle***

People: Human Factors

- ***Ignorance of the hazard***

- ***Mission focused***

- ***Traveled through an area many times and it was always safe before***

- ***Brain not engaged***

- ***Don’t know don’t go; you control this***

Overloading

- ***Additional Snow Fall (more than 1 inch an hour)***
- ***Windloading***
- ***Cornice Breaks***
- ***Personnel/Vehicles***

Demolitions

- Trigger avalanche(s) prior to moving
- Must be detonated in the correct position
- Could give away position

General Indicators of Avalanche Prone Terrain

- ***Evidence of previous slides***
- ***Steep slopes between 30-45 degrees***
- ***Recent heavy snowfall adding to the weight of snowpack***
- ***Visible fracture lines in the snow***
- ***Audible settling of the snowpack***
- ***Severe temperature changes***
- ***Lee slopes***
- ***Snow plumes and high winds***
- ***Slushy spring snow***
- ***Outside force to break the stability***

Tree
gin

Route Selection: <u>Is there a SAFER route?</u>

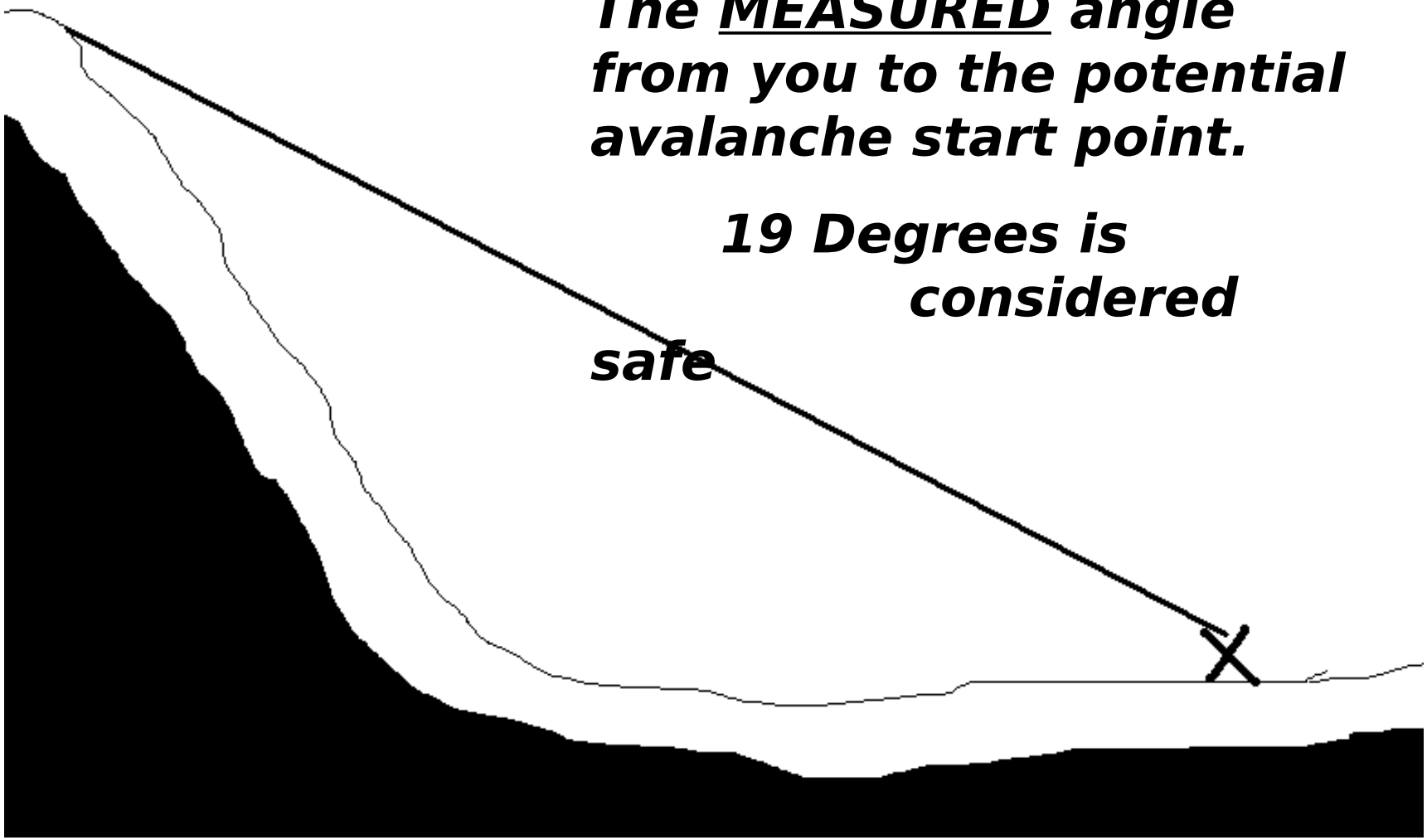
Route Selection: Travel in Valleys

- ***Traffic in the valley floor can trigger slides from above.***
- ***How will you know the risks?***
- ***Consider your Run-out Angle for safe travel in valleys***

Run-Out Angle

The <u>MEASURED</u> angle from you to the potential avalanche start point.

19 Degrees is considered safe



Hazard Evaluation: Snow Pack Analysis

- *Ski-pole*
- *Snow-pit*
- *Shovel Shear*
- *Rutschblock Test*
- *Banzai Test*

AVALANCHE HAZARD EVALUATION CHECKLIST

Critical Data		Hazard Rating		
PARAMETERS:	**KEY INFORMATION**	**G**	**Y**	**R**
TERRAIN: *Is the terrain capable of producing an avalanche?*				
-Slope angle (steep enough to slide? prime time?)		☐	☐	☐
-Slope aspect (leeward, shadowed, or extremely sunny?)		☐	☐	☐
-Slope configuration (anchoring? shape?)		☐	☐	☐
	Overall Terrain Rating:	☐	☐	☐
SNOWPACK: *Could the snow fail?*				
-Slab Configuration (slab? depth and distribution?)		☐	☐	☐
-Bonding Ability (weak layer? tender spots?)		☐	☐	☐
-Sensitivity (how much force to fail? shear tests? clues?)		☐	☐	☐
	Overall Snowpack Rating:	☐	☐	☐
Weather: *Is the weather contributing to instability?*				
-Precipitation (type, amount, intensity? added weight?)		☐	☐	☐
-Wind (snow transport? amount and rate of deposition?)		☐	☐	☐
-Temperature (storm trends? effects on snowpack?)		☐	☐	☐
	Overall Weather Rating:	☐	☐	☐
Human: *What are your alternatives and their possible consequences?*				
-Attitude (toward life? risk? goals? assumptions?)		☐	☐	☐
-Technical Skill Level (traveling? evaluating aval. hazard?)		☐	☐	☐
-Strength/Equipment (strength? prepared for the worst?)		☐	☐	☐
	Overall Human Rating:	☐	☐	☐

Decision/Action:
Overall Hazard Rating/GO or NO Go? **GO ☐ or NOGO ☐**

***HAZARD LEVEL SYMBOLS:**
R = Red light (stop/dangerous)
G = Green light (go/OK)
Y = Yellow light (caution/potentially dangerous).

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Necessary Equipment in Avalanche Country

- ***Avalanche Probe***
- ***Shovel***
- ***Transceiver***
- ***Slope angle measuring device***

Crossing a Questionable Slope

- Loosen equipment
  - Remove pole straps from wrists Disconnect safety leashes from skis
  - Loosen rucksack straps
- Cross one at a time with a watch posted

If Caught in an Avalanche

- ***Attempt to release skis***
- ***Remove heavy rucksack***
- ***Use Swimming Motion***
- ***Create an Air Space***
- ***Try to find the surface***

If you witness others caught in an avalanche

- ***Keep your eyes on the victims.***
- ***Note terrain traps***
- ***Look for surface clues***
- ***Organize search***
- ***Don't go for help. YOU ARE THE HELP!***

Avalanche Hazards Summary

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Standard: Student evaluated avalanche potential in different areas. Student chose safe routes in terrain with avalanche potential. Student utilized special equipment to recover personnel and equipment from a mock avalanche